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⑤④ **Diagnostic device for colour sorting apparatus.**

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Description

The present invention relates to a diagnostic device for use in a colour sorting apparatus.

A colour sorting apparatus is used for automatically separating grains with a colour different from a reference colour from grains to be sorted such as rice grains, wheat, red beans, soy beans, and peanuts. In such colour sorting apparatus, it is necessary to provide a large number of sorting channels because only one grain at a time is subjected to the sorting operation and therefore there are usually provided 20 to 30 sorting channels. A colour sorting apparatus of the kind to which the diagnostic device according to the present invention may be applied and which has a large number of sorting channels is found in, for example, the United States Patent No. 3,738,484. With a colour sorting apparatus of this kind, if there occurs any malfunction even in only one of those sorting channels, this causes unacceptable grains to be mixed in the acceptable grains which have been sorted, thereby seriously deteriorating the sorting performance of the apparatus.

Accordingly, it is a primary object of the present invention to provide a diagnostic device for use in a colour sorting apparatus which is capable of detecting from among a large number of sorting channels a particular sorting channel which is out of order.

Another object of the present invention is to provide a diagnostic device for use in a colour sorting apparatus which is capable of controlling the feeders so that the feeding of grains to the malfunctioning sorting channel is interrupted thus contributing to the promotion of a better sorting performance of the apparatus.

In accordance with the present invention, there is provided a diagnostic device for use in a colour sorting apparatus having a plurality of sorting channels, the device comprising: a scanner circuit means having a plurality of switching circuits respectively connected to a plurality of measuring points in each of the sorting channels, the switching circuits being operable to select one after another a particular sorting channel to be measured among the sorting channels; a comparator circuit means for comparing output signals measured at the respective measuring points within the selected sorting channel with reference signals preset for the respective measuring points; and an alarm means for indicating the malfunctioning portion of the selected sorting channel which is out of order upon receipt of the signals from the scanner circuit means and the comparator circuit means, whereby the malfunctioning sorting channel and the malfunctioning portion therein are indicated by the alarm means if there is a discrepancy between the reference signals and the output signals when compared by the comparator circuit means.

The present invention also provides a diagnostic device which further comprises a feeder control means for controlling the operation of feeders respectively arranged for the sorting channels

upon receipt of the signals from the scanner circuit means and the comparator circuit means, whereby the malfunctioning sorting channel and the malfunctioning portion therein are indicated by the alarm means and the feeding of grains to the malfunctioning sorting channel is interrupted if there is a discrepancy between the reference signals and the output signals when compared by the comparator circuit means.

One way of carrying out the invention is described in detail below with reference to the drawing which illustrates only one specific embodiment, in which a single Figure shows a block diagram of one preferred embodiment in accordance with the present invention.

In the drawing, the references Q1—Qn represent respective sorting channels disposed within the colour sorting apparatus. These respective sorting channels Q1—Qn comprise: light sensitive sensors S1—Sn for detecting the amount of light from the reference background and the amount of reflected and/or transmitted light from the grains flowing so as to be sorted; pre-amplifiers A1—An for amplifying the outputs fed from the sensors S1—Sn; main amplifiers B1—Bn; and comparators C1—Cn for comparing the outputs sent from the main amplifiers B1—Bn with the reference outputs set-up by means of level setters K1—Kn and producing outputs at the passage of a grain of a colour different from the colour (hereinafter referred to as a substandard grain). Output signals from the comparators C1—Cn are delayed by signal delay circuits D1—Dn and driver circuits E1—En are activated so as to actuate electromagnetic valves F1—Fn of an ejector, thereby blowing off the substandard grain with compressed air from the ejector when the substandard grain passes in front of the ejector. Measuring points a1—an which are output points of the pre-amplifiers A1—An, measuring points b1—bn which are output points of the main amplifiers B1—Bn, measuring points c1—cn which are output points of the comparators C1—Cn and measuring points d1—dn which are collector terminals of the transistors adapted to activate the electromagnetic valves F1—Fn of the ejector are respectively connected to a-point switching circuit 3, b-point switching circuit 4, c-point switching circuit 5 and d-point switching circuit 6 of a scanner circuit means which includes a pulse generator circuit 1, a scanner driver circuit 2 and these a-, b-, c-, d-point switching circuits 3, 4, 5, 6. These a-, b-, c-, d-point switching circuits 3, 4, 5, 6 and the switching circuit 7, hereunder to be explained, are operated to switch their stationary contacts one to another successively by the scanner by the scanner driver circuit 2 which is adapted to be operable in response to the pulses fed from the pulse generator circuit 1.

The outputs of the scanner circuit means are applied to a comparator circuit means which includes amplifiers Ma—Md, wave processing circuits Wa—Wd, comparators Ha—Hd, reference waveform generator circuits W'a—W'd and an OR gate G. Thus, the respective outputs of the a-, b-,

c-, and d-point switching circuits 3, 4, 5 and 6 are applied, through the respective amplifiers Ma—Md and the wave processing circuits Wa—Wd, to the respective comparators Ha—Hd, to which reference signals are also applied from the reference waveform generator circuits W'a—W'd, where the signals from the wave processing circuits Wa—Wd are compared with the above reference signals, respectively. The outputs of the comparators Ha—Hd are input to the OR gate G and the output of this OR gate G is in turn applied to a feeder control means, that is, the above switching circuit 7. Outputs of this switching circuit 7 are respectively connected to feeders X1—Xn which are means for feeding or stopping the grains to the respective sorting channels. The outputs of the comparators Ha—Hd are also applied to a display device 8 which is arranged also to receive an output signal from the abovementioned scanner driven circuit 2 and which is further connected to an alarm device 9 such as a buzzer or bell. An alarm means may be formed by the display device 8 alone or together with the alarm device 9.

Next, the operation of the diagnostic device for the colour sorting apparatus embodying the present invention will be explained below.

Let us suppose that the colour sorting apparatus is now in an operating state and that grains to be sorted are flowing down in each of the sorting channels Q1—Qn. Under this condition, each of the sensors S1—Sn for the respective sorting channels Q1—Qn detects the colour of the grains flowing down the respective channels and sends out a certain detection signal. On the other hand, the scanner driver circuit 2 operates upon receipt of the pulse signals from the pulse generator circuit 1 to drive the respective a-, b-, c-, d-point switching circuits 3, 4, 5, 6 and the switching circuit 7 so as to switch their respective contacts in succession from 1 to n stationary contacts in a synchronous manner. Let us now suppose that, for example, the stationary contacts "2" in the respective switching circuits are selected by the scanner driver circuit 2. The respective measuring points a2, b2, c2, d2, within the sorting channel Q2 are electrically connected through the respective a-, b-, c-, d-point switching circuits 3, 4, 5, 6 to the amplifiers Ma—Md where the output signals measured at the respective measuring points a2, b2, c2, d2 are amplified. The signals being amplified at the amplifiers Ma—Md are then passed to the wave processing circuits Wa—Wd where they are wave-processed so as to be made applicable for the comparison operation, and in turn passed to the comparators Ha—Hd where the processed signals are compared with the reference signals produced by means of the reference waveform generator circuits W'a—W'd. Under these circumstances, when at least one of the processed signals does not correspond to the associated reference signal, corresponding one of the comparators Ha—Hd sends out a signal which causes the feeder X2, through the OR gate G and the selected stationary contact "2" of the switch-

ing circuit 7, to stop the feeding of grains to the sorting channel Q2.

The display device 8 receives the output signals from the comparators Ha—Hd and is arranged to operate to indicate each sorting channel number synchronously with the stationary contacts of the respective switching circuits 3—7 by the scanner driver circuit 2. Thus, supposing that the comparator Hb sends out an output signal, the display device 8 operates to indicate the number, which in this case is number "2", representing the present number of the particular sorting channel undergoing measuring operation which has been selected by the respective switching circuits 3—6, and also the display device 8 operates to indicate the character "b", based upon the output signal from the comparator Hb, representing the measuring point where any malfunction has occurred. As a result, there will be an indication of "2—b" showing that there is a malfunction at the b-point within the sorting channel Q2. In addition to this visual indication, the alarm device 9 of bells or the like operates to give warning of an occurrence of any malfunction in an audible manner.

In the above described embodiment, there are arranged four measuring points per sorting channel within the apparatus, but five or six or more measuring points may well be arranged if desired. The increase in measuring points will ensure circumstantial discovery of malfunctioning portions.

As has been described hereinabove, the first advantageous effect offered by the present invention is that when any portion within the sorting channel is out of order within the colour sorting apparatus having a large number of sorting channels, the malfunctioning sorting channel and the malfunctioning portion therein are indicated on the display device so that any malfunctioning parts can be quickly discovered and repaired.

The second advantageous effect, in addition to the one given above, is that since the feeding of grains to the sorting channel out of order can be timely stopped, there is less possibility of sub-standard grains being mixed in the acceptable grains and this contributes to the promotion of better sorting performance, and also the fact that the malfunctioning sorting channel can be quickly restored means the improvement of overall sorting efficiency of the colour sorting apparatus.

While the invention has been described in its preferred embodiment, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

Claims

1. A diagnostic device for a colour sorting apparatus having a plurality of sorting channels (Q1—Qn), the device being characterised by:

a scanner circuit means (1—6) having a plurality of switching circuits (3—6) respectively connected to a plurality of measuring points (a1—an,

b1—bn, c1—cn, d1—dn) in each of said sorting channels, the switching circuits (3—6) being operable to select one after another successively a particular sorting channel to be measured among said sorting channels;

a comparator circuit means (Ma—Md, Wa—Wd, W'a—W'd, Ha—Hd, G) for comparing output signals measured at said respective measuring points within said selected sorting channel with reference signals preset for said respective measuring points; and

an alarm means (8, 9) for indicating the malfunctioning portion of said selected sorting channel which is out of order upon receipt of the signals from said scanner circuit means and said comparator circuit means,

whereby the malfunctioning sorting channel and the malfunctioning portion therein are indicated by said alarm means if there is a discrepancy between said reference signals and said output signals when compared by said comparator circuit means.

2. A diagnostic device for a colour sorting apparatus as claimed in claim 1, wherein said alarm means comprises a display device (8) for indicating the malfunctioning sorting channel and the malfunctioning portion therein.

3. A diagnostic device according to either of claims 1 and 2, wherein said alarm means comprises an alarm device (9) for warning of an occurrence of any malfunction in an audible manner.

4. A diagnostic device according to any one of claims 1 to 3 further comprising a feeder control means (7), for controlling the operation of feeders respectively arranged for said sorting channels, upon receipt of said signals from said scanner circuit means and said comparator circuit means,

whereby the feeding of grains to said malfunctioning sorting channel is interrupted if there is a discrepancy between said reference signals and said output signals when compared by said comparator circuit means.

Patentansprüche

1. Diagnosevorrichtung für ein Farbsortiergerät mit einer Vielzahl von Sortierkanälen (Q1—Qn), gekennzeichnet durch

eine Abtastschaltungseinrichtung (1—6) mit einer Vielzahl von Schaltungen (3—6) mit Umschaltfunktion, die jeweils mit einer Vielzahl von Meßpunkten (a1—an, b1—bn, c1—cn, d1—dn) in jedem der Sortierkanäle verbunden sind, wobei die Schaltungen (3—6) mit Umschaltfunktion so arbeiten können, daß sie einen einzelnen zu messenden Sortierkanal unter den Sortierkanälen nacheinander auswählen,

eine Komparatorschaltungseinrichtung (Ma—Md, Wa—Wd, W'a—W'd, Ha—Hd, G) zum Vergleichen der an den jeweiligen Meßpunkten im gewählten Sortierkanal gemessenen Ausgangssignale mit für die jeweiligen Meßpunkte vorgegebenen Bezugssignalen, und

eine Alarmeinrichtung (8, 9) zum Anzeigen des

fehlerhaft arbeitenden Teils des gewählten Sortierkanals der gestört ist, auf den Empfang der Signale von der Abtastschaltungseinrichtung und der Komparatorschaltungseinrichtung,

wobei der fehlerhaft arbeitende Sortierkanal und der fehlerhaft arbeitende Teil darin durch die Alarmeinrichtung angezeigt werden, wenn zwischen den Bezugssignalen und den Ausgangssignalen eine Nichtübereinstimmung herrscht, wenn sie durch die Komparatorschaltungseinrichtung verglichen werden.

2. Diagnosevorrichtung für ein Farbsortiergerät nach Anspruch 1, bei dem die Alarmeinrichtung eine Anzeigeeinrichtung (8) zum Anzeigen des fehlerhaft arbeitenden Sortierkanals und des fehlerhaft arbeitenden Teils darin umfaßt.

3. Diagnosevorrichtung nach einem der Ansprüche 1 und 2, bei der die Alarmeinrichtung einen Alarmgeber (9) zum hörbaren Warnen vor dem Auftreten einer Fehlerfunktion umfaßt.

4. Diagnosevorrichtung nach einem der Ansprüche 1 bis 3, mit einer Beschickungssteuer-einrichtung (7) zum Steuern der Arbeit von Zuliefereinrichtungen, die jeweils für die Sortierkanäle angeordnet sind, auf den Empfang der Signale von der Abtastschaltungseinrichtung und der Komparatorschaltungseinrichtung,

wobei die Zuführung von Korn zu dem fehlerhaft arbeitenden Sortierkanal unterbrochen wird, falls eine Nichtübereinstimmung zwischen den Bezugssignalen und den Ausgangssignalen auftritt, wenn diese durch die Komparatorschaltungseinrichtung verglichen werden.

Revendications

1. Dispositif de diagnostic pour un appareil de triage colorimétrique comportant une pluralité de canaux de triage (Q1—Qn), ce dispositif étant caractérisé par:

des moyens formant circuit d'exploration par balayage (1—6) possédant une pluralité de circuits de commutation (3—6) raccordés respectivement à une pluralité de points de mesure (a1—an, b1—bn, c1—cn, d1—dn) dans chacun desdits canaux de triage, les circuits de commutation (3—6) pouvant fonctionner de manière à sélectionner successivement, l'un après l'autre, un canal de triage particulier, dans lequel la mesure doit être exécutée, parmi lesdits canaux de triage;

des moyens formant circuit comparateur (Ma—Md, Wa—Wd, W'a—W'd, Ha—Hd, G) servant à comparer les signaux de sortie mesurés au niveau desdits points respectifs de mesure à l'intérieur dudit canal de triage sélectionné, à des signaux de référence préétablis pour lesdits points de mesure respectifs; et

des moyens d'alarme (8, 9) servant à indiquer la partie dudit canal de triage sélectionné, qui fonctionne mal et qui est hors service lors de la réception des signaux délivrés par lesdits moyens formant circuit d'exploration par balayage et desdits moyens formant circuit comparateur, ce qui a pour effet que la canal de triage, qui fonctionne mal, et la partie, qui fonctionne mal, dans ce canal

sont indiqués par lesdits moyens d'alarme s'il existe une différence entre lesdits signaux de référence et lesdits signaux de sortie lorsque ces signaux comparés par lesdits moyens formant circuit comparateur.

2. Dispositif de diagnostic pour un appareil de triage colorimétrique selon la revendication 1, dans lequel lesdits moyens d'alarme comportent un dispositif d'affichage (8) servant à indiquer le canal de triage qui fonctionne mal et la partie, qui fonctionne mal, à l'intérieur de ce canal.

3. Dispositif de diagnostic selon l'une ou l'autre des revendications 1 et 2, dans lequel lesdits moyens d'alarme comprennent un dispositif d'alarme (9) destiné à avertir, d'une manière audible, et signaler l'apparition d'un quelconque défaut de fonctionnement.

4. Dispositif de diagnostic selon l'une quelconque des revendications 1 à 3, comportant en outre des moyens (7) de commande de dispositifs d'alimentation, servant à commander le fonctionnement de dispositifs d'alimentation prévus respectivement pour lesdits canaux de triage, lors de la réception desdits signaux en provenance desdits moyens formant circuit d'exploration par balayage et desdits moyens formant circuit comparateur,

ce qui a pour effet que l'envoi de grains audit canal de triage, qui fonctionne mal, est interrompu s'il existe une différence entre lesdits signaux de référence et lesdits signaux de sortie, lorsque ces signaux sont comparés par lesdits moyens formant circuit comparateur.

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